METHOD OF MANUFACTURING ORGANIC ELECTROLUMINESCENCE DISPLAY DEVICE

BACKGROUND OF THE INVENTION

1.Field of the Invention

The present invention relates to a method of manufacturing an organic electroluminescence display device (organic EL display device) comprising an electroluminescence layer (organic EL layer) for emitting a light by the application of a current.

2.Description of the Related Art

In the organic electroluminescence display device of this type, generally, a large number of stripe-shaped anode electrodes 12 formed by a transparent conductive film are arranged in parallel at a proper interval on a back face 11b opposite to a surface 11a in a transparent substrate 11 such as a glass, an electroluminescence layer 13 is overlaid on each of the stripe-shaped anode electrodes 12, a large number of stripe-shaped cathode electrodes 14 formed by a metal layer are arranged on the electroluminescence layer 13 in parallel at a proper interval in such a direction as to cross the stripe-shaped anode electrode 12, and a current is applied between any of the stripe-shaped anode electrodes 12 and any of the stripe-shaped cathode electrodes 14 to emit a light to the electroluminescence layer 13 in a portion provided therebetween so that a character is displayed on the surface 11a side in the transparent substrate 11 as shown in Figs. 1 to 3.

A cover 15 for wholly covering the stripe-shaped anode electrode 12, the electroluminescence layer 13 and the stripe-shaped cathode electrode 14 is attached to the back face 11b in the transparent substrate 11.

When an organic electroluminescence display device having this structure is to be manufactured, conventionally, there is employed a first method in which "the large number of stripe-shaped anode electrodes 12 are

first formed on the back face 11b of the transparent substrate 11, the organic electroluminescence layer 13 is then overlaid thereon, and a metal mask comprising a through hole according to the pattern of the large number of stripe-shaped cathode electrodes 14 formed by the metal layer is overlaid on the surface of the organic electroluminescence layer 13, and the stripe-shaped cathode electrodes 14 are formed by the metal layer through vacuum evaporation of metal from thereabove, or

a second method in which "the large number of stripe-shaped anode electrodes 12 are formed on the back face 11b of the transparent substrate 11, a cathode partition layer is then overlaid thereon by a photoresist and is subjected to patterning according to the stripe-shaped cathode electrodes 14 by photolithography using pattern exposure and baking and a development processing, and the organic electroluminescence layer 13 is formed between the cathode partition layers and the stripe-shaped cathode electrode 14 is thereafter formed on the surface of the cathode partition layer."

In these manufacturing methods, however, there is a problem in that the steps of forming the stripe-shaped cathode electrode 14 is remarkably increased and complicated, resulting in a considerable increase in a manufacturing cost.

In addition, as in the former case, the method of forming the stripe-shaped cathode electrode 14 by vacuum evaporation using a metal mask has a problem in that the dimension and shape of each of the stripe-shaped cathode electrodes 14 depends on that of the through hole in the metal mask, resulting in a reduction in precision in the dimension and shape and the difficulty of an increase in fineness. In the method of forming the stripe-shaped cathode electrode 14 as in the latter case, moreover, there is a problem in that an increase in fineness is limited and the alignment of a pattern is hard to perform.

SUMMARY OF THE INVENTION

The invention has a technical object to provide a manufacturing method which solves these problems.

In order to attain the technical object, a first aspect of the invention is directed to a method of manufacturing an organic electroluminescence display device comprising the steps of:

forming a large number of stripe-shaped anode electrodes by a transparent conductive film on a surface of a transparent substrate;

forming an organic electroluminescence layer on the surface of the transparent substrate in superposition on the anode electrodes;

forming a metal layer to be a stripe-shaped cathode electrode on a surface of the organic electroluminescence layer;

sticking a light transmitting peeling film to the metal layer through an adhesive which is previously coated on one side of the peeling film and has adhesion to the metal layer reduced by irradiation of ultraviolet light;

baking, onto the peeling film, a pattern according to the stripe-shaped cathode electrodes extended in such a direction as to cross the stripe-shaped anode electrodes through the irradiation of the ultraviolet light by using a mask overlaid thereon; and

peeling the peeling film from the organic electroluminescence layer.

Moreover, a second aspect of the invention is directed to the method of manufacturing an organic electroluminescence display device according to the first aspect of the invention, wherein the peeling film is peeled in such a direction that the stripe-shaped cathode electrode is extended.

As described above, the metal layer for the stripe-shaped cathode electrode is formed on the surface of the organic electroluminescence layer, the peeling film is stuck to the surface of the metal layer with the precoated adhesive, and the pattern according to the stripe-shaped cathode electrodes is baked by the irradiation of ultraviolet light onto the peeling film by using the mask. In the portion of the adhesive on which the ultraviolet light are irradiated, consequently, adhesion to the metal layer is reduced.

The peeling film is peeled from the organic electroluminescence layer. Consequently, the portion of the metal layer in which the ultraviolet light

are irradiated on the adhesive remains on the organic electroluminescence layer side, and other portions are peeled and removed from the organic electroluminescence layer together with the peeling film. Thus, the metal layer in the portion remaining on the organic electroluminescence layer side constitutes a large number of stripe-shaped cathode electrodes.

In other words, according to the invention, a large number of stripe-shaped cathode electrodes can be formed at the step of sticking the peeling film to the organic electroluminescence layer, baking the pattern of the stripe-shaped cathode electrode onto the peeling film through ultraviolet light and peeling the peeling film. Consequently, the damage of the organic electroluminescence layer can be reduced and fineness can be increased. In addition, it is possible to have such an advantage that the steps can be carried out much more easily than that in the related art and a manufacturing cost can be reduced considerably.

As described in the second aspect of the invention, particularly, the peeling film is peeled in such a direction that the stripe-shaped cathode electrode is extended. When the peeling film is to be peeled, consequently, the generation of a cut in the middle over the portion of the conductive adhesive which remains on the organic electroluminescence layer side can be lessened. Thus, it is possible to produce such an advantage that the rate of generation of defective products can be reduced reliably.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a longitudinal sectional front view showing an organic electroluminescence display device,

Fig. 2 is a sectional view taken along a line II – II in Fig. 1,

Fig. 3 is a perspective view showing the inner part of the organic electroluminescence display device,

Fig. 4 is a perspective view showing a state in which a stripe-shaped anode electrode is formed on a transparent substrate according to the invention,

Fig. 5 is a sectional view taken along a line V – V in Fig. 4,

Fig. 6 is a perspective view showing a state in which an organic electroluminescence layer is formed on a transparent substrate in superposition on the stripe-shaped anode electrode according to the invention,

Fig. 7 is a sectional view taken along a line VII – VII in Fig. 6,

Fig. 8 is a sectional view showing a state in which a metal layer is formed on the organic electroluminescence layer according to the invention,

Fig. 9 is a sectional view showing a state in which a peeling film is stuck to the metal layer according to the invention,

Fig. 10 is a perspective view showing a mask to be used in the invention,

Fig. 11 is a sectional view taken along a line XI – XI in Fig. 10,

Fig. 12 is a sectional view showing a state in which the peeling film is baked by using the mask according to the invention,

Fig. 13 is a sectional view showing a state in which the peeling film is peeled according to the invention,

Fig. 14 is a sectional view taken along a line XIV – XIV in Fig. 13, and

Fig. 15 is a perspective view showing a state obtained after the peeling film is peeled according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the invention will be described below with reference to Figs. 4 to 14.

First of all, a large number of stripe-shaped anode electrodes 12 formed by a transparent conductive film are arranged in parallel at a proper interval on a back face 11b opposite to a surface 11a in a transparent substrate 11 such as a glass constituting the organic electroluminescence display device shown in Figs. 1 to 3 by a conventional well-known method as shown in Figs. 4 and 5.

Subsequently, an electroluminescence layer 13 is formed on the back face 11b in the transparent substrate 11 such as a glass by a conventional

well-known method as shown in Figs. 6 and 7.

Next, a metal layer A is formed on the surface of the electroluminescence layer 13 by metal vacuum evaporation or sputtering as shown in Fig. 8.

Then, a peeling film B formed by a light transmitting soft synthetic resin is stuck to the surface of the metal layer A through adhesion using an adhesive C precoated on a back face thereof as shown in Fig. 9.

In this case, a material which is cured by the irradiation of ultraviolet light to reduce adhesion to the metal layer A is used for the adhesive C.

On the other hand, as shown in Figs. 10 and 11, there is prepared a mask D in which a slit hole D1 having a shape in conformity with the shape of each stripe-shaped cathode electrode 14 in the organic electroluminescence display device is provided in the same pattern.

As shown in Fig. 12, the mask D is overlaid on the surface of the peeling film B and ultraviolet light E are irradiated from thereabove. Consequently, a pattern according to the stripe-shaped cathode electrodes 14 is baked onto the peeling film B.

By the irradiation of the ultraviolet light, the adhesion to the metal layer A is reduced in a portion of the adhesive C on which the ultraviolet light are irradiated in the slit hole D1 portion of the mask D.

As shown in Figs. 13 and 14, the peeling film B is peeled from the organic electroluminescence layer 13. Consequently, only the portion of the metal layer A in which the ultraviolet light are irradiated on the adhesive C remains in a state of bonding to the organic electroluminescence layer 13 side and other portions are peeled and removed from the organic electroluminescence layer 13 together with the peeling film B.

In other words, a large number of stripe-shaped cathode electrodes 14 are formed by the metal layer A in a predetermined pattern over the surface of the organic electroluminescence layer 13.

When the peeling film B is to be peeled, moreover, the peeling is carried out in such a direction that the stripe-shaped cathode electrode 14 is

extended as shown in Fig. 14. When the peeling film B is to be peeled, consequently, it is possible to reliably lessen the generation of a cut in the middle in the portion of the metal layer A which remains on the organic electroluminescence layer 13 side, that is, the stripe-shaped cathode electrode 14 portion.